

## investigations of Martian Geodesy Through Lander Tracking

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Mars Pathfinder will have a radio system for direct-to-Earth communications. This communications link also allows range and Doppler measurements. Range and Doppler measurements between the lander and the Earth will contain signatures due to the rotational variations of Mars. A regular program of tracking of the lander, when combined with tracking data from the Viking landers, will allow determination of the precession constant of Mars, and hence its polar moment of inertia, with an accuracy of about 0.2%, a factor of 5 to 10 improvement over the accuracy obtained from the Viking data alone. This improvement comes partly from the improved ranging accuracy capability of the Pathfinder radio system (due to use of X-band (8.3 GHz) rather than the S-band (2.3 GHz) system used for the Viking data), and partly from the longer time span of data between the start of the Viking mission and the end of the Pathfinder mission (24 years) compared to the time span of the Viking mission alone (6 years). The precise determination of the polar moment of inertia is critical in determining the past climate of Mars over the last few million years and provides a tight constraint on models for the mantle composition.

Beyond Pathfinder other missions may include landers with a radio link to the Earth, possibly as a back-up communications link. If multiple landers are located so that they can be simultaneously visible from Earth then differential tracking of the landers can provide for further improvement in the determination of Mars rotation. Studies have been performed for the INTERMARSNET mission where three landers would be simultaneously tracked one hour per week for one Martian year.

Error budgets will be given for single and multiple lander measurements. Results of covariance analysis indicating the accuracy with which lander positioning and Mars orientation can be determined will be presented.

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